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ABSTRACT

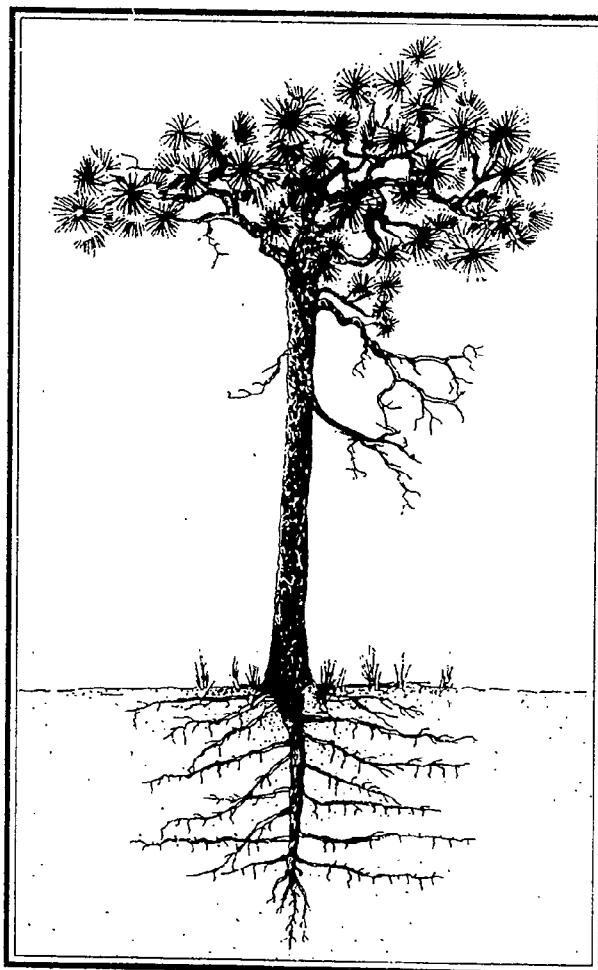
This curriculum guide was developed to provide environmental education through a series of hands-on activities for the classroom and the outdoor setting of Weymouth Woods-Sandhills Nature Preserve, North Carolina. This activity packet, designed for grades 5 and 6, meets established curriculum objectives of the North Carolina Department of Public Instruction's Standard Course of Study. Students are exposed to the following major concepts: classification of plants, life cycle of a longleaf pine, methods of determining the age of trees, benefits of natural and prescribed fires to the longleaf pine, and ways the trees have adapted to fire. The packet is divided into eight sections: (1) introduction to the North Carolina State Parks System, Weymouth Woods-Sandhills Nature Preserve, and the activity packet; (2) activity summary; (3) pre-visit activities; (4) on-site activities; (5) post-visit activities; (6) vocabulary and definitions; (7) references; and (8) a scheduling worksheet, parental permission form, and program evaluation. Activity information includes curriculum objectives for each grade level, location, group size, estimated time, appropriate season, materials, major concepts, objectives, educator's information, student's information, and worksheets. (LZ)

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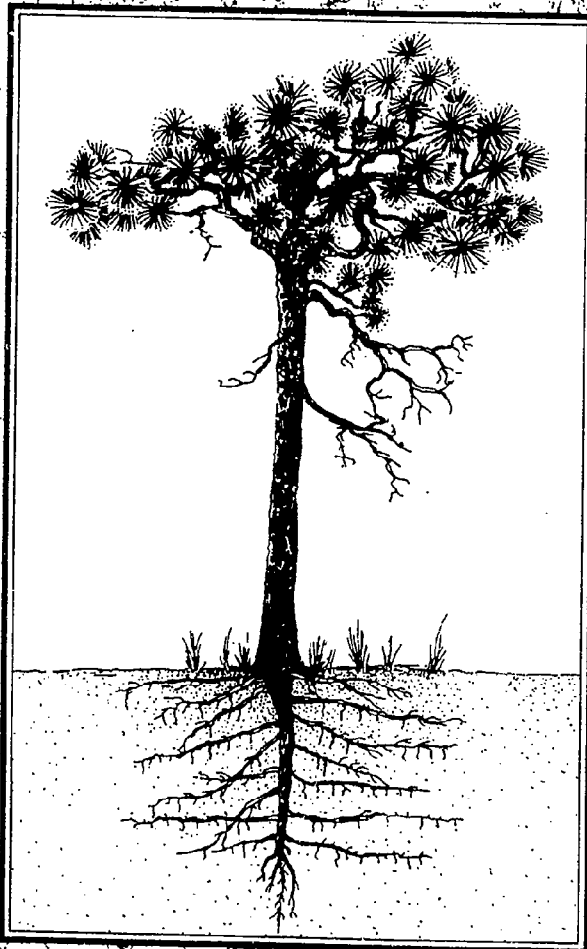
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I N T I M E

Weymouth Woods - Sandhills Nature Preserve
An Environmental Education Learning Experience
Designed for Grades 5-5

SE055310

R O O T E D



I N T I M E

Platte River Sandhills Nature Preserve
An Outdoor Education Learning Experience
Designed for Grades 5-6

*"For any true nature lover of that day,
it must have been a thrilling experience
to have traversed the seemingly
endless mazes of the virgin long leaf
pine forest amid the sixty to one
hundred feet high boles, under
the shady tasseled tops whispering or
roaring eternally in the winds.
Underfoot was the deep brown carpet
of needles, broken here and there
by wire-grass tussocks. So compact was
the needle-leaved canopy that
trail travelers of that early day could go
for miles in comfortable shade."*

*- B. W. Wells,
The Natural Gardens of North Carolina*

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CP&L

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was developed by

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Weymouth Woods - Sandhills Nature Preserve

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The N.C. Department of Environment, Health
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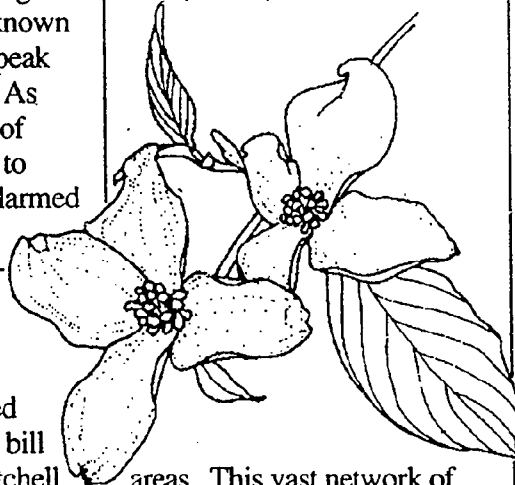
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Introduction to the North Carolina State Parks System

Preserving and protecting North Carolina's natural resources is actually a relatively new idea. The seeds of the conservation movement were planted early in the 20th century when citizens were alerted to the devastation of Mount Mitchell. Logging was destroying a well-known landmark - the highest peak east of the Mississippi. As the magnificent forests of this mile-high peak fell to the lumbermen's axe, alarmed citizens began to voice their objections. Governor Locke Craig joined them in their efforts to save Mount Mitchell. Together they convinced the legislature to pass a bill establishing Mount Mitchell as the first state park of North Carolina. That was in 1915.

The North Carolina State Parks System has now been established for more than three quarters of a century. What started out as one small plot of public land has grown into 59 properties across the state, including parks, recreation areas, trails, rivers, lakes and natural



areas. This vast network of land boasts some of the most beautiful scenery in the world and offers endless recreation opportunities. But our state parks system offers much more than scenery and recreation. Our lands and waters contain unique and valuable archaeological, geological and biological resources that are important parts of our natural heritage.

As one of North Carolina's principal conservation agencies, the Division of Parks and Recreation is responsible for the more than 125,000 acres that make up our state parks system. The Division manages these resources for the safe enjoyment of the public and protects and preserves them as a part of the heritage we will pass on to generations to come.

An important component of our stewardship of these lands is education. Through our interpretation and environmental education services, the Division of Parks and Recreation strives to offer enlightening programs which lead to an understanding and appreciation of our natural resources. The goal of our environmental education program is to generate an awareness in all individuals which cultivates responsible stewardship of the earth.

For more information contact:

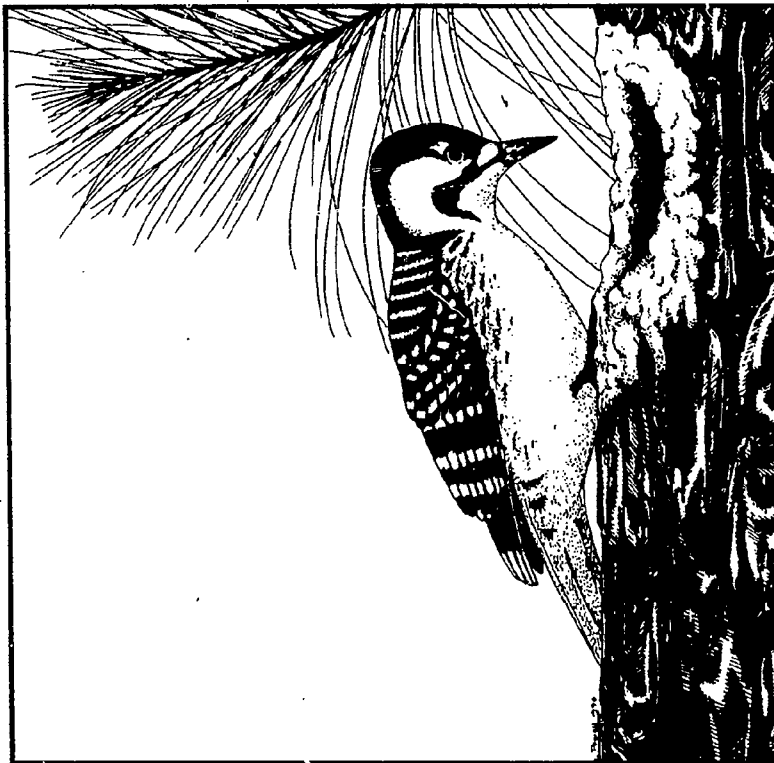
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Introduction to Weymouth Woods -Sandhills Nature Preserve

The Sandhills region once contained a vast longleaf pine forest ecosystem and covered one million acres in south-central North Carolina. The outstanding features of the region, sandy flat-topped ridges, gave the area its name. Lumbering and naval stores operations were responsible for removing most of the original growth of the longleaf pine forest. Today, Weymouth Woods - Sandhills Nature Preserve consists of a longleaf pine and turkey oak ecosystem that covers the slopes of the ridges, with hardwoods filling the bottomlands.

In years past, naturally occurring fires were necessary for the longleaf pine and wiregrass ecosystem to thrive. Without fire, many plants, such as wiregrass, various wildflowers and the insectivorous plants found in the bogs or along James Creek, would not produce seeds or even bloom. Recognizing this need, yet cautious of the hazards of uncontrolled natural fires, the park staff at Weymouth Woods has implemented a management plan that uses controlled, human-made fires (prescribed burns) to preserve this unique ecosystem.

The fire management plan at Weymouth Woods plays a key role in maintaining the longleaf pine and wiregrass ecosystem for the many ani-



Red-Cockaded Woodpecker

illustration by Consie Powell

mals living in the Sandhills Nature Preserve. An example of an animal that depends on fire to maintain its habitat is the endangered red-cockaded woodpecker. This bird will nest only in the heartwood of mature, live pine trees and it must have an open pine forest in which to forage. Prescribed burns eliminate the competing oaks and help to maintain an open understory.

A full-time resident, the red-cockaded woodpecker is a social bird, living with its family or clan. A clan may consist of a breeding pair and the immature young from the previous year. All birds in the

clan help with feeding, defending territory and digging new cavities in the live pine trees. Each bird in the clan will have its own roosting cavity, making a colony of cavity trees. A clan and its descendants will use the same roosting and breeding cavities for years, as it may take several years to excavate new cavities.

Some of the mammals that share the longleaf forest with the red-cockaded woodpecker are gray and red foxes, white-tailed deer, cottontail rabbits and fox squirrels. The native fox squirrel is larger than the typical gray squirrel, living variable amounts of time on

its head, body and tail. Along James Creek there may be evidence of raccoon, mink and beaver.

Weymouth Woods - Sandhills Nature Preserve was the first natural area added to the North Carolina state parks system. The original 403 acres were donated in 1963 by the widow of James Boyd, a North Carolina author. This new natural area was named after the Boyd Family estate, known as Weymouth, so named because the Sandhills reminded James Boyd of the natural surroundings of Weymouth, England. The original 403-acre donation has grown into over 700 acres on three different tracts of land, each representing unique natural features of the Sandhills region.

Scheduling a Trip:

1. Please contact the park at least two weeks in advance to make a reservation.
2. Complete the Scheduling Worksheet located on page 8.1, and return it to the park as soon as possible.
3. Research activity permits may be required for sampling activities. If your group plans to collect any plant, animal or mineral within the park, please contact the park office at least 30 days in advance to obtain a permit application.

Before the Trip:

1. Complete the pre-visit activity in the Environmental Education Learning Experience.
2. The group leader should

visit the park without the participants prior to the group trip. This will enable you to become familiar with the facilities and park staff, and to identify any potential problems.

3. The group leader should discuss park rules and behavior expectations with adult leaders and participants. Safety should be stressed.
4. Everyone should wear a name tag. Please color-code tags (for groups) and establish a buddy system.
5. Activities that take place outdoors may expose participants to insects and seasonal weather conditions. Be prepared by dressing accordingly and wearing sunscreen or insect repellent, if necessary. Comfortable walking shoes should also be worn.

6. *The group leader is responsible for obtaining a parental permission form from each participant, including a list of any health considerations and medical needs. An example of this form is on page 8.2.*

7. *If you will be late or need to cancel your trip, please notify the park as far ahead as possible.*

While at the Park:

Please obey the following rules:

1. To help you get the most out of the experience

and increase your chance of observing wildlife, be as quiet as possible while in the park.

2. On hikes, walk behind the leader at all times. Running is not permitted.

3. All plants and animals within the park are protected. Damaging plants and harming animals are prohibited in all state parks. This allows future visitors the same opportunity to enjoy our natural resources.

4. Picnic in designated picnic areas only. Help keep the park clean and natural; do not litter.

5. In case of accident or emergency, contact park staff immediately.

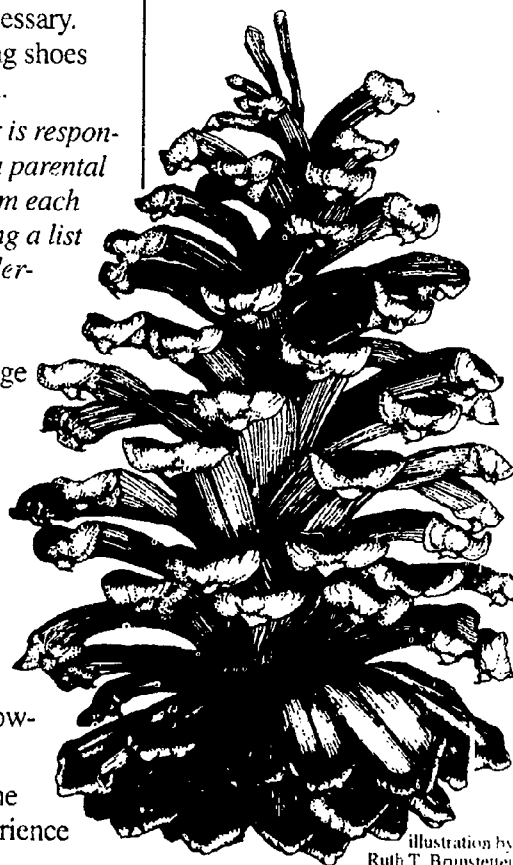


Illustration by
Ruth T. Brunstetter



illustration by Consie Powell

Prescribed Burn

Following the Trip:

1. Complete the post-visit activity in the Environmental Education Learning Experience packet.
2. Build upon the field experience and encourage participants to seek answers to questions and problems encountered at the park.
3. Relate the experience to classroom activities and

curriculum through reports, projects, demonstrations, displays and presentations.

4. Give tests or evaluations, if appropriate, to determine if students have gained the desired information from the experience.

5. File a written evaluation of the experience with the park. Evaluation forms are available in the activity packet on page 8.3.

Park Information:

Weymouth Woods
- Sandhills Nature Preserve
400 N. Fort Bragg Road
Southern Pines, NC 28387
Fax# (910) 692-8042
Telephone (910) 692-2167

Office Hours:

Year round - 9:00 am - 6:00 pm
Monday-Friday

Hours Of Operation:

Nov - Mar	9:00 am - 6:00 pm
Apr - Oct	9:00 am - 7:00 pm
Sundays	Noon - 5:00 pm

Introduction to the Activity Packet for Weymouth Woods - Sandhills Nature Preserve

The Environmental Education Learning Experience, *Rooted In Time*, was developed to provide environmental education through a series of hands-on activities for the classroom and the outdoor setting of Weymouth Woods-Sandhills Nature Preserve. This activity packet, designed for grades 5 and 6, meets established curriculum objectives of the North Carolina Department of Public Instruction's Standard Course of Study. Three types of activities are included:

- 1) pre-visit activity
- 2) on-site activity
- 3) post-visit activity

The on-site activity will be conducted at the park, while pre-visit and post-visit activities are designed for the classroom. Pre-visit activities should be introduced prior to the park visit so that students will have the necessary background and vocabulary for the

on-site activities. We encourage you to use the post-visit activities to reinforce concepts, skills and vocabulary learned in the pre-visit and on-site activities. These activities may be performed independently, however they have been designed to be done in a series to build upon the students' newly gained knowledge and experiences.

The Environmental Education Learning Experience, *Rooted In Time*, will expose the students to the following major concepts:

- Classification of plants
- Life cycle of a longleaf pine
- Methods of determining the age of trees
- Benefits of natural and prescribed fires to the longleaf pine and ways the trees have adapted to fire

The first occurrence of vocabulary words used in these

activities is indicated in **bold type**. Their definitions are listed in the back of the activity packet. A list of the reference materials used in developing the activities follows the vocabulary list.

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Note:

On-site activities may require hiking which could expose the students to hot, humid conditions and ticks. Accessibility to some of these areas may be difficult for persons with disabilities. Contact a park ranger for suggestions on modifying the on-site activities for students with disabilities. When conducting the on-site activity, please remember that collecting specimens of any kind in the park is prohibited.

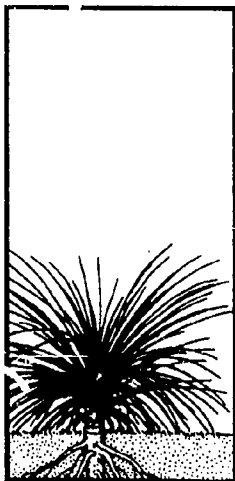
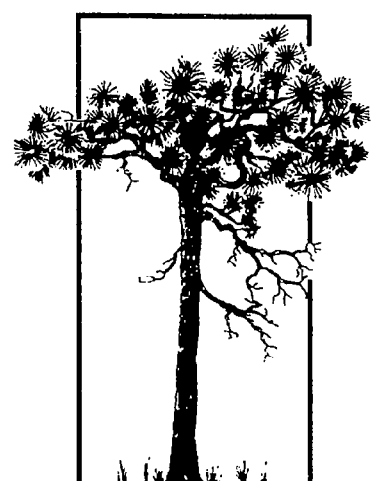


illustration by Consie Powell



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Ruth T. Brunstetter



Activity Summary

The following outline provides a brief summary of each activity, the major concepts introduced and the objectives met by completion of the activity.

I. Pre-Visit Activity

#1 Tree Trivia (page 3.1.1)

Through a game, the students will learn the developmental growth stages of the longleaf pine tree. An introduction and class discussion of the different growth stages will precede playing the game.

Major concepts:

- Plant adaptations
- Identification of the longleaf pine
- Observation skills

Objectives:

- List three adaptations which help establish the longleaf pine as the main species of pine tree occurring in the Sandhills region.
- Name the four different growth stages of the longleaf pine.

II. On-Site Activity

#1 The Habitat Needs of the Longleaf Pine (page 4.1.1)

Using provided materials, the students will make and record observations as well as answer questions which will lead to conclusions about the habitat needs of the longleaf pine.

Major Concepts:

- Plant adaptations
- Prescribed burn
- Resource management
- Observation skills

Objectives:

- Explain the importance of fire to the longleaf pine.
- Explain the importance of sandy soil to the longleaf pine.



Illustration by
Ruth T. Brunstetter

III. Post-Visit Activity

#1 Tree Cookies (page 5.1.1)

Using cross-sections of longleaf pines and a magnifying glass, students will record on data sheets the historical events that occurred during the life of the pine. Students will also be introduced to the use of an increment borer - what it is, who uses it and why.

Major concepts:

- Plant growth
- History and environment
- Observation skills

Objectives:

- List four difficulties, natural or human-made, that longleaf pines may endure during their life span of 300-500 years.

Pre-Visit Activity #1

Tree Trivia

Curriculum Objectives:

Grade 5

- Communication Skills: listening and visual comprehension
- Guidance: competency and skill for interaction with others
- Science: Earth science, environment
- Social Studies: organize and analyze information, draw conclusions and participate effectively in groups

Grade 6

- Communication Skills: study skills using environmental sources, reading, vocabulary and viewing comprehension
- Science: biology
- Social Studies: analyze information and draw conclusions

Location: Classroom.

Group Size:

3 teams with 10 members each

Estimated Time: 45 minutes

Appropriate Season: Any

Materials:

Provided by the educator:

Per class - one set of the question cards, masking tape, 3 poster size tree templates, 3 sets of the tree template pieces

Per student - Student's Information sheet

Major Concepts:

- Plant adaptation:
- Identification of the longleaf pine
- Observation skills

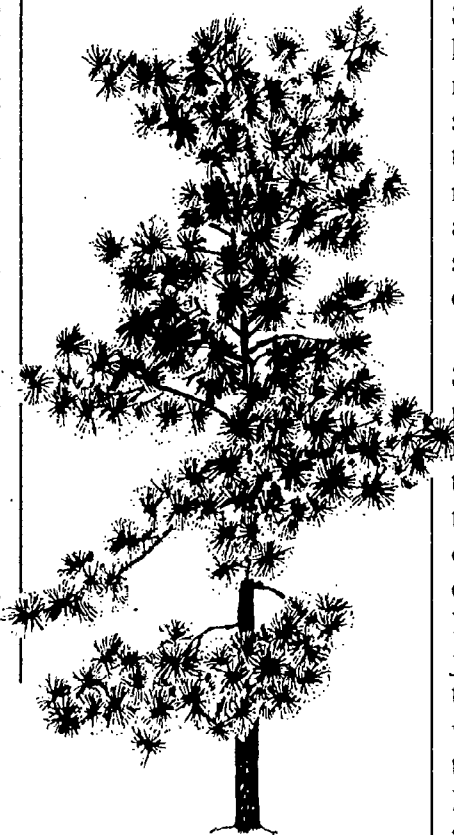
Objectives:

- List three adaptations that help establish the longleaf pine as the main species of pine tree occurring in the Sandhills region.
- Name the four different growth stages of the longleaf pine.

Educator's Information:

The longleaf pine was once the predominant species of tree across the landscape of the southeastern United States, including the area known today as the **Sandhills** region. In this activity, the students will learn what makes this species of pine tree so representative of the region, and how it has **adapted** to the sometimes harsh environment of the Sandhills.

Students should read the Student's Information sheet prior to the game. This information will inform them about tree growth from seeds to maturity, with a special emphasis on the developmental stages of the longleaf pine tree. The longleaf pine tree has four major stages, each contributing to the tree's survival. This game will help prepare the students to recognize each stage of the longleaf pine's growth when they visit the preserve for the on-site activity.



illustrations by
Ruth T. Brunstetter

Instructions:

1. Note to teacher: Enlarge and make two copies (per team) of Tree Template page on 11" x 17" paper. Use one copy as a template; cut the other into 12 pieces as shown.
2. Have the students read and look at the illustrations on the Student's Information sheet. Discuss this information as a class before playing the game.
3. Place the students into three teams with approximately 10 students per team. Have them stand in straight lines (one behind the other) with their team. Tape a template of the tree on

the chalkboard or wall in front of each team. Place a set of game pieces and the tape near each team so that they can be placed on the template.

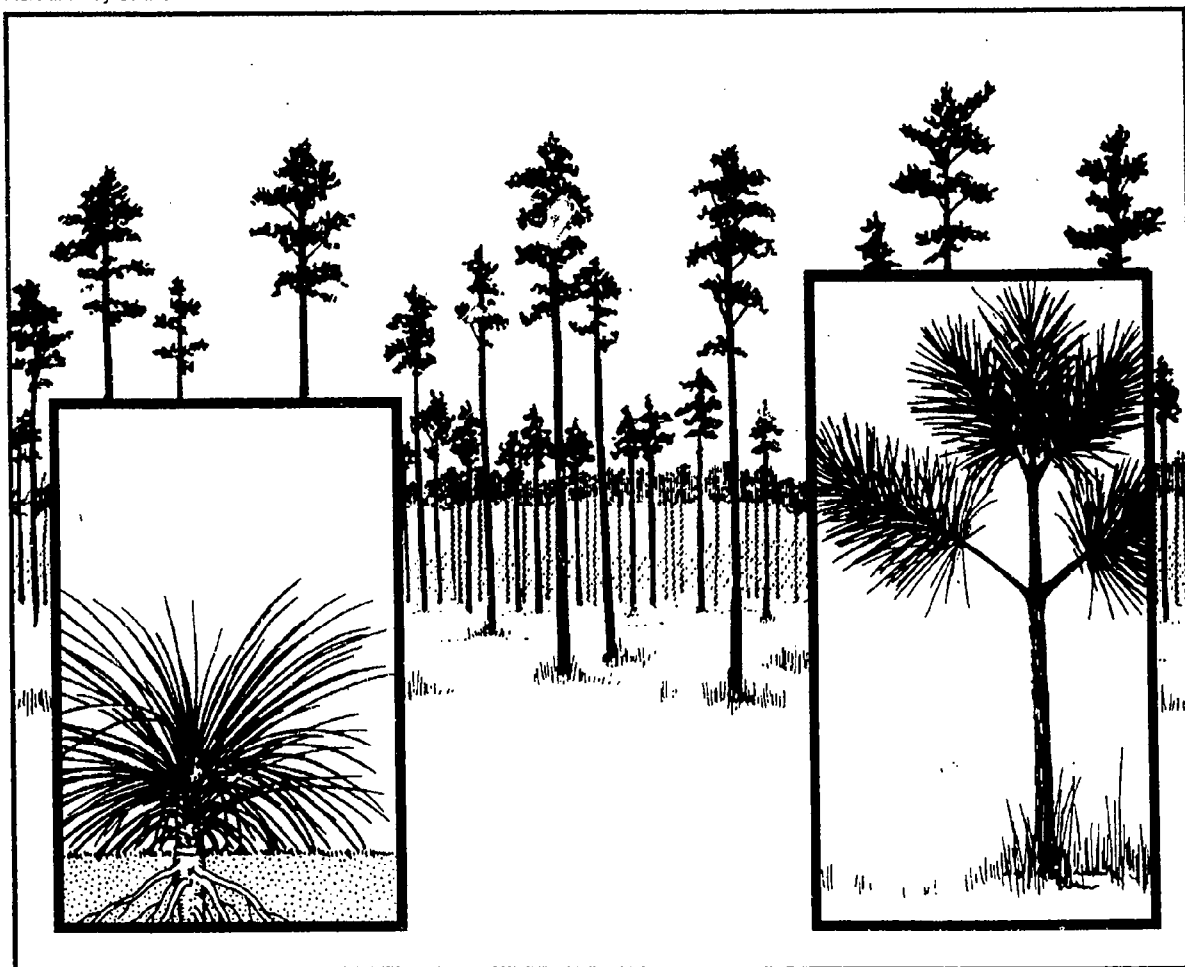
4. The students at the head of each line will be the first three contestants. The educator will read the entire question from the first question card. The first hand raised and recognized by the educator will have the first chance to answer the question. (Correct answers will be in bold on the card.) If the question is answered incorrectly, the first of the other two remaining players to raise their

hand and be recognized may answer.

5. If the question is answered correctly, then that team member will tape the first game piece (starting with the roots, as numbered) to the template located on the wall in front of his/her team. The first three contestants will return to the back of their team's line and the next members will be ready for the next question. This will continue until one team fills in their team's template with all the pieces.

6. Return the used card to the bottom of the stack and use again, if necessary.

illustration by Consie Powell



Student's Information

There are different groups of plants just like there are different groups of animals. We group animals into birds, mammals, reptiles and so on. Similarly, we can place trees into one of two large groups: hardwoods or **conifers**. Hardwood trees have flat leaves of varying width and produce flowers. Many, but not all, hardwood trees are deciduous. In the spring, they sprout new leaves from buds that were dormant during the winter, and

in the fall, the leaves change color and drop to the ground. **Coniferous** trees have scaly or needle-like leaves and produce cones. Many conifers are also called evergreens because the trees appear to remain green throughout the year.

Within each of these large groups there are family groups of trees, such as the oak family in the hardwoods and the pine family in the conifers. The families can be broken down into individual members with

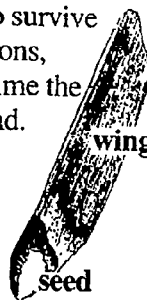
their individual names just like your own family. The individual family members are called **species** such as the turkey oak species in the oak family and the **longleaf pine** species in the pine family. The longleaf pine species will be the focus of this exercise.

The longleaf pine is a special species of pine because of its ability to prosper in the area known as the **Sandhills** region of North Carolina. The Sandhills is a sometimes harsh environment in which to live because any plant growing there must have the ability to find or store water and also be able to survive the wildfires that once burned across the land. The longleaf pine has developed ways to survive such harsh conditions, starting from the time the seeds hit the ground.

The seed has a wing attached to it so that the wind can carry it to an area away from the main tree (see illustration). When these seeds start to fall, they are sometimes called "helicopters" because they spin like a helicopter propeller. Very soon after landing on suitable soil, the seed germinates. In the Sandhills there are basically two types of soil. One is called organic soil and is composed of peat (dead decaying plant material). The other is mineral soil and is composed



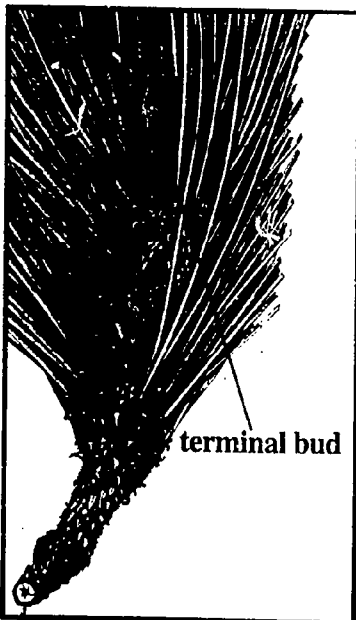
illustration by ©Anne Marshall Runyon



of sand. Longleaf pine seeds grow best when they land on mineral soil.

After germination, the young pine consists of a few small pine leaves and a developing root system. In this stage of life, the longleaf pine's root system is basically the only part of the tree that grows. This first stage

of growth is called the seedling stage, or grass stage, because the longleaf pine looks like a clump of grass. Most of the growth is taking place underground where the **tap root** is growing longer and longer. This long root will help the tree survive periods of dry weather by reaching deeper and moister soil and also storing water. The needles above the ground grow to their full size of 10 to 15 inches, but there is no stem



or tree trunk yet. In the winter and early spring, these long needles protect the **terminal bud** (see illustration) from wildfires that burn across the land. The longleaf pine may stay in this stage for three to seven years.

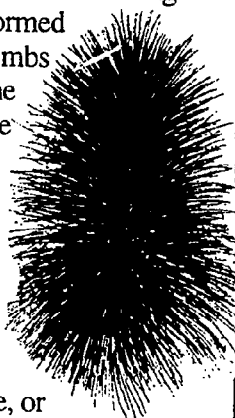


After the initial period of root system growth, the longleaf pine is well established and now begins to grow upwards. The terminal bud begins to shoot upwards, creating

the stem or trunk of the tree.

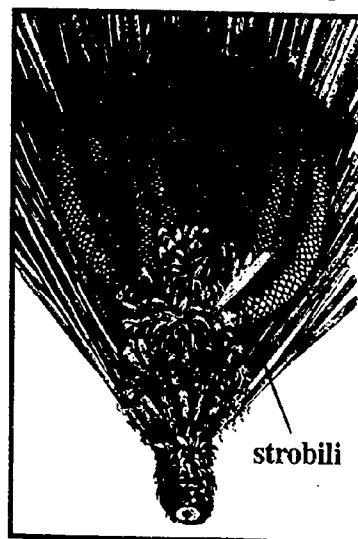
The needles stick out along the newly formed trunk. No limbs appear on the longleaf pine until the environmental conditions are just right. This stage is called the sapling stage, or "bottlebrush," because the tree looks like a brush that is used to clean bottles (see illustration). It may take a few years before the longleaf pine begins to grow limbs and many years before it is old enough to produce its first pine cone.

The first pine cone may not be produced until the longleaf pine is 20 to 25 years old. This stage is called the mature growth stage and may last until the tree reaches its last stage at 100+ years. The thin limbs of the longleaf pine will be near the top of the tree as the lower limbs fall off. All the



long needles are located at the end of each stem creating a cheerleader's "pom-pom" effect. During this period, the tree is very productive and is producing pine cones full of seeds.

Pine cone production is very important for the longleaf pine tree and the animals that eat the seeds. This makes the mature growth stage important for **reproduction** and survival of the longleaf pine forest **ecosystem**. The longleaf pines that make it to this stage will grow two kinds of pine cones: **pollen cones** and **seed cones**. The pollen cones or male cones called **strobili**, produce **pollen** and can be found growing as a group on the end of each limb in the spring (see illustration). In most other species of pines, pollen cones are yellow, but the male cones of the longleaf pine are purple.



The yellow pollen that comes from the strobili spreads through the air like dust. Once all the pollen is shed from the

male cones, they fall to the ground.

Seed cones, or female cones, are at first very small and sticky. Pollen grains carried by the wind stick to a seed cone. Tubes grow from the pollen grains into egg cells inside the seed cones. Sperm enters an egg cell and **fertilizes** the egg. Each fertilized egg cell grows into a seed.

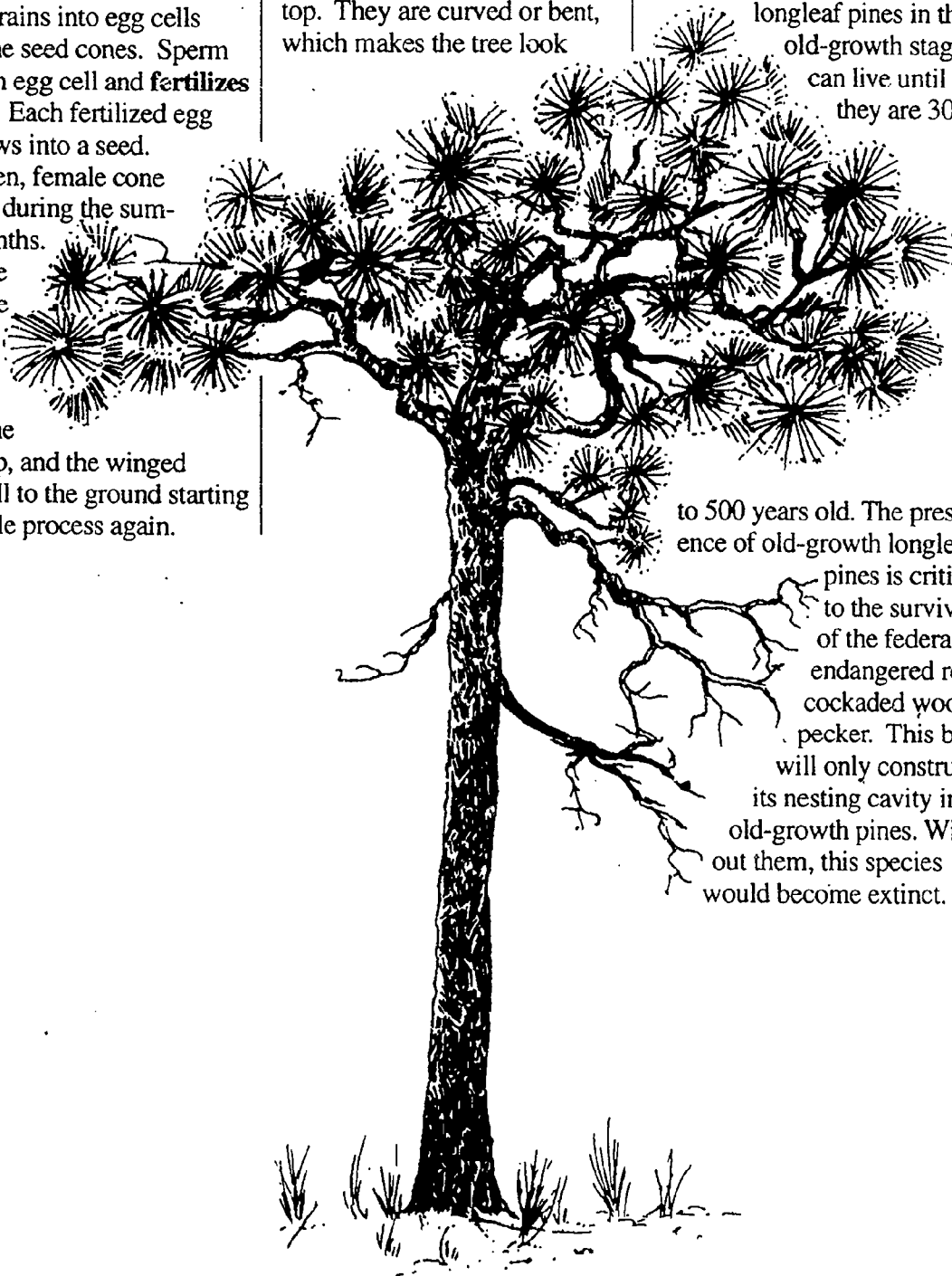
The green, female cone matures during the summer months.

Once the seeds are formed, the now brown pine cone opens up, and the winged seeds fall to the ground starting the whole process again.

The longleaf pine enters its last stage of growth when it reaches over 100 years of age. This stage, called the old-growth stage, can be recognized because all the limbs, now thick, are near the tree's top. They are curved or bent, which makes the tree look

flat-topped (see illustration). The trees that make it to this stage are called "flat-tops." Flat-topped trees do not grow any taller but grow thicker trunks and limbs. They can still produce pine cones. The longleaf pines in the old-growth stage can live until they are 300

to 500 years old. The presence of old-growth longleaf pines is critical to the survival of the federally endangered red-cockaded woodpecker. This bird will only construct its nesting cavity in old-growth pines. Without them, this species would become extinct.



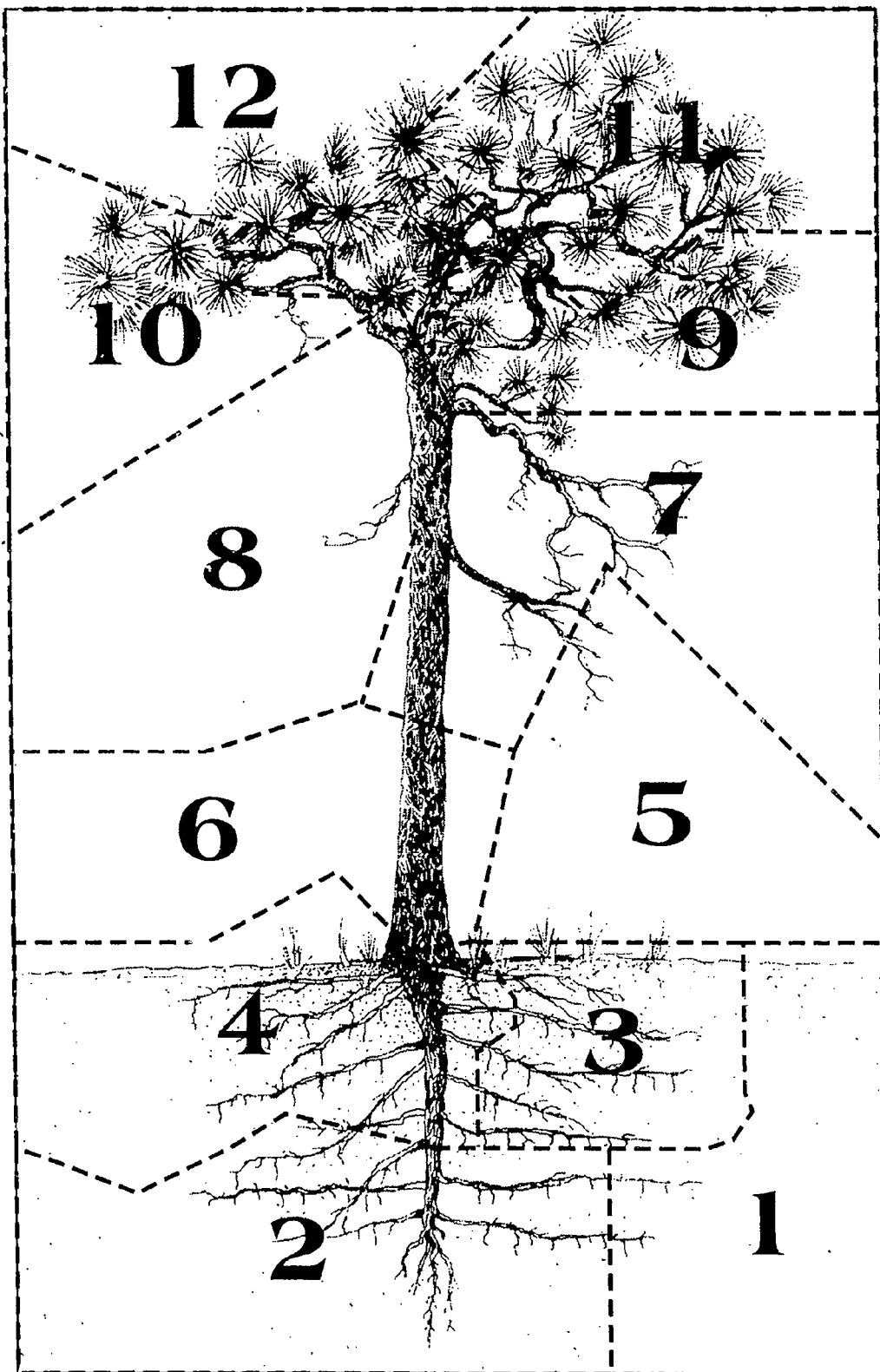
Tree Trivia Playing Cards

<p>To what large group do pine trees belong?</p> <p>a) hardwood b) conifer c) fern d) grass</p>	<p>What develops from the longleaf pine seedling that helps it to survive in the dry soil?</p> <p>a) needle b) helicopter c) tap root d) terminal bud</p>
<p>Pine trees lose all their needles in the fall.</p> <p>a) True b) False</p>	<p>What is the first stage of growth for the longleaf pine?</p> <p>a) mature stage b) grass stage c) old-growth d) bottlebrush</p>
<p>This game is about what species of tree?</p> <p>a) turkey oak b) loblolly pine c) longleaf pine d) pond pine</p>	<p>How many years does the longleaf pine tree stay in the grass-stage?</p> <p>a) 1 - 2 years b) 8 - 10 years c) 20 - 25 years d) 3 - 7 years</p>
<p>In what geographic region of North Carolina do longleaf pines survive the best?</p> <p>a) Mountain b) Piedmont c) Barrier Islands d) Sandhills</p>	<p>What is the full length of the longleaf pine's needles?</p> <p>a) 10-15 inches b) 2-6 inches c) 6-10 inches d) 30 - 35 inches</p>
<p>What is the nickname for the pine seeds as they fall to the ground?</p> <p>a) helicopter b) pom-pom c) wing d) tap root</p>	<p>At what age do longleaf pines reach their last stage of growth?</p> <p>a) 250 years b) 300 years c) 100+ years d) 50 years</p>

Tree Trivia Playing Cards

<p>What is the second stage of growth for the longleaf pine?</p> <p>a) mature stage b) grass stage c) old-growth d) bottlebrush</p>	<p>What is the name of a male pine cone?</p> <p>a) seed cone b) pollen cone or strobili c) helicopter d) conifer</p>
<p>What is the last stage of growth for the longleaf pine?</p> <p>a) mature stage b) grass stage c) old-growth d) bottlebrush</p>	<p>What growth stage does the following statement describe? A tuft of green needles seen above the ground, and a long taproot below the ground.</p> <p>a) mature stage b) grass stage c) old-growth d) bottlebrush</p>
<p>At what stage of growth do longleaf pines first produce pine cones?</p> <p>a) mature stage b) grass stage c) all stages d) bottlebrush</p>	<p>What growth stage does the following statement describe? No limbs or cones produced, with only green needles sticking out from the main stem.</p> <p>a) mature stage b) grass stage c) old-growth d) bottlebrush</p>
<p>How long do longleaf pines live?</p> <p>a) 200-300 years b) 300-400 years c) 300-500 years d) 300-700 years</p>	<p>What growth stage does the following statement describe? Large trunk with thin, straight limbs and producing many pine cones.</p> <p>a) mature stage b) grass stage c) old-growth d) bottlebrush</p>
<p>Longleaf pines produce two different pine cones.</p> <p>a) True b) False</p>	<p>What growth stage does the following statement describe? Large trunk with thick, curved limbs all near the top of the tree.</p> <p>a) mature stage b) grass stage c) old-growth d) bottlebrush</p>

Tree Template



On-Site Activity #1

The Habitat Needs of the Longleaf Pine

Curriculum Objectives: Grade 5

- Communication Skills: listening and visual comprehension
- Guidance: competency and skill for interacting with others
- Healthful Living: recreational safety
- Math: measurement, probability and statistics
- Science: Earth science, environment
- Social Studies: locate, gather, organize and analyze information, draw conclusions and participate effectively in groups

Grade 6

- Communication Skills: study skills using environmental sources, reading, vocabulary and viewing comprehension
- Guidance: competency and skill for interacting with others
- Healthful Living: environmental health
- Math: measurement, probability and statistics
- Science: ecology
- Social Studies: organize and analyze information, draw conclusions and participate effectively in groups

Location: Lighter-Stump Trail

Group Size:

30 students, 4 or 5 students per groups

Estimated Time: 2 to 2.5 hours

Appropriate Season:
April through October

Materials:

Provided by park: 4 soil moisture probes, 4 tape measures, 4 calculators, 1 erasable board and Class Summary Sheet

Per student: clip board

Provided by educators:

Per student: pencils, "Study Group Summary Sheet," "Habitat Needs of the Longleaf Pine Data Sheet"

Special Considerations:

This activity may expose the students to hot, humid conditions and ticks. Accessibility to some of these areas may be difficult for persons with disabilities. When conducting the on-site activity, please remember that collecting specimens of any kind in the park is prohibited.

Major Concepts:

- Plant adaptations
- Prescribed burn
- Resource management
- Observation skills

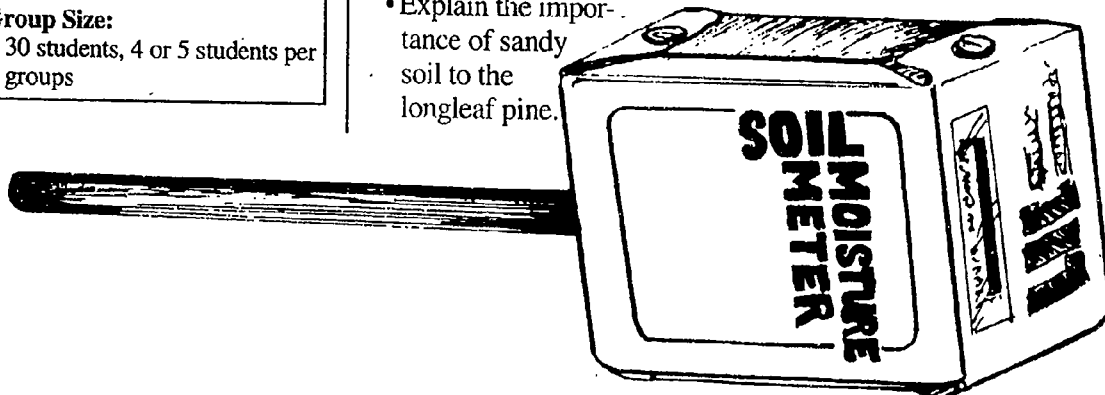
Objectives:

- Explain the importance of fire to the longleaf pine.
- Explain the importance of sandy soil to the longleaf pine.

Educator's Information:

This activity will be conducted along Lighter-Stump Trail in Weymouth Woods - Sandhills Nature Preserve.

In the **Sandhills** habitat, the students will be asked to make observations, answer questions and to record this information on data sheets. Park staff will mark off four plots along the Lighter-Stump Trail. Plots 1 and 2 will be in an area recently burned by **prescribed burning**. Plots 3 and 4 will be in an unburned area. The students will observe how **plant communities** of the Sandhills have **adapted** to natural fires, which have occurred every 3-5 years for thousands of years. They will also learn why prescribed burns are conducted by park staff at Weymouth Woods - Sandhills Nature Preserve.



Instructions:

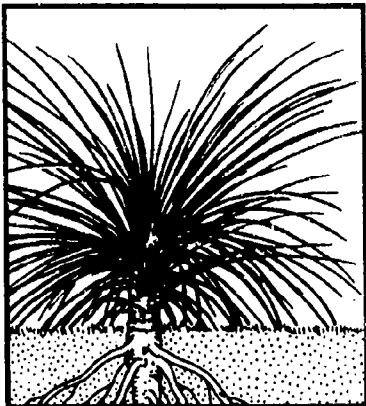
Prior to visit:

Have the students read the background information on "The **Ecology** of the Sandhills." Discuss this topic as a class prior to the park visit. Emphasize to the students that the **habitat** for the Sandhills' plant communities includes sandy soils and the need for fires, both of which are essential for the growth and health of these plants. Make up a packet for each student that will include one copy of the Habitat Needs of the Longleaf Pine Data Sheet and one copy of the Study Group Summary Sheet. The Class Summary Sheet will only be used by the educator.

At the Preserve:

1. Divide the students into four study groups with four to five students per group. Name each group A, B, C, or D. Within the small groups, have the students draw numbers and remember the number chosen. These numbers will establish the order of leaders during the Study Group Summary Sheet.

illustration by Consie Powell



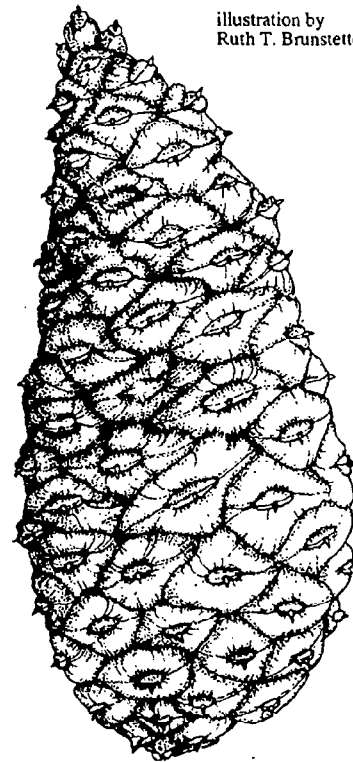
activity. One adult will be needed per group.

2. Have the students join their assigned study group. Each study group receives a soil moisture probe, a calculator, a measuring tape, a clipboard and five pieces of flagging tape. The educator will have a copy of the Habitat Needs of the Longleaf Pine Data Sheet and a Study Group Summary Sheet for each student to be clipped to the clipboard.

3. Each study group will be assigned a plot that is numbered 1 through 4 along the Lighter-Stump Trail. The park staff will have already marked off the corners of the four, 10 x 10 meter plots. These plots consist of two recently burned areas (plots 1 & 2) and two plots that have not been burned (plots 3 & 4).

4. Park staff will assist the students in finding the four corners of the plot and marking these with flagging tape. Have two members of the study group measure the line between two marked corners and find the half-way point. Use the flagging tape to mark this point. Repeat on all four sides. Stretch the tape through the center of the plot from the half-way mark on one of the sides to the half-way mark on the opposite side. Mark the half-way point. Repeat this step with the two sides that were not used the first time. Once both sides are completed, the place where the measuring tape would cross

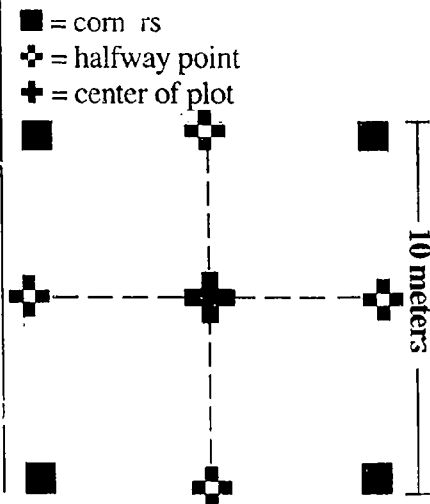
illustration by
Ruth T. Brunstetter



green female cone

itself should be the center of the plot. This will create four sub-plots (see illustration).

Each member of the study group will collect data from one of the four sub-plots. Each member will answer the questions on the Habitat Needs of the longleaf Pine Data Sheet for his/her sub-plot.



5. All members will need to SHARE the soil moisture meter. To use the soil moisture meter, place the tip a few inches into the ground of the sub-plot and record the number shown. The tip is the only sensitive part of the probe. 6 - 10 is wet and 0 - 5 is dry.

6. Once all the members of the study group have finished their data sheets, the students will assist the group leader in answering the questions on the Study Group Summary Sheet. The order for the group leaders was assigned by the number chosen during the earlier drawing. For example, the student that chose number 1 will be the leader in plot 1. The group leader will need to use the calculator in order to complete the Study Group Summary Sheet.

7. The study groups will move to the next plot. **DO NOT REMOVE THE FLAGGING TAPE FROM THE PLOT.**

Each member chooses a sub-plot within the next plot and repeat steps 5 and 6. The only difference will be in the group leader. For example student #2 will be the group leader and complete the Study Group Summary sheet for plot 2. Repeat all steps for plots 3 and 4, changing group leaders at each plot. The adult with each of the groups can assist the students in working on the summary sheets. The educator will provide assistance by floating between groups.

8. Upon completion of these exercises, the students will gather at the Visitor Center. A spokesperson will be appointed from each study group to assist the educator in constructing a graph on the eras-

able board using the information collected on the Study Group Summary Sheets. The graph will represent all four plots by combining the data of both burned and unburned sites. Once the graph is complete, the students will use it to participate in a class discussion.

9. The spokesperson will use the Study Group Summary Sheets from their own group to fill in the chart on the Class Summary Sheet. The educator will average the data on the Class Summary Sheet for all study groups. Then, the educator will create a graph on the erasable board. (See example on the Class Summary Sheet.)

10. Display the completed graph so that the class can participate in a class discussion. Questions are provided on the Class Summary Sheet.



Student's Information



illustration by Consie Powell

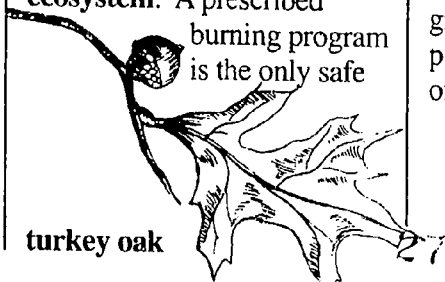
The Ecology of the Sandhills

This activity focuses on the **habitat** of the Sandhills' **plant communities**. In this exercise, you will observe the habitat of specialized plant communities and recognize the positive effects **prescribed burns** have on these plants. **Ecology** refers to the interrelationship between living beings and their surroundings. The ecology of the **Sandhills** is therefore the relationship between the plants and animals and the soil, water and air upon which they depend. Ecology also includes the relationships with natural phenomena, such as wildfires, tornadoes and hurricanes.

An important part of the ecology of the Sandhills is fire. Fire helps keep the **longleaf pine** forest open by limiting the growth of shrubs and hardwoods. It opens up the under-story and allows a rich array of wildflowers and grasses to quickly resprout from their underground roots. They thrive

in the abundant sunlight and **nutrients** released from the ash of burned plants. Fire also prepares seed beds for longleaf pine by removing fallen leaves and exposing the mineral soil necessary for successful longleaf seed germination.

Many animals found in the Sandhills region depend on fires to maintain the open longleaf pine habitat. One interesting example is the red-cockaded woodpecker, a federally endangered **species**. A full-time resident, the bird makes its home only in the **heartwood** of living, old-growth longleaf pine trees. Another example is the fox squirrel. This large, secretive squirrel varies in color from gray to black and is rarely found outside of the longleaf pine, turkey oak and wiregrass **ecosystem**. A prescribed burning program is the only safe

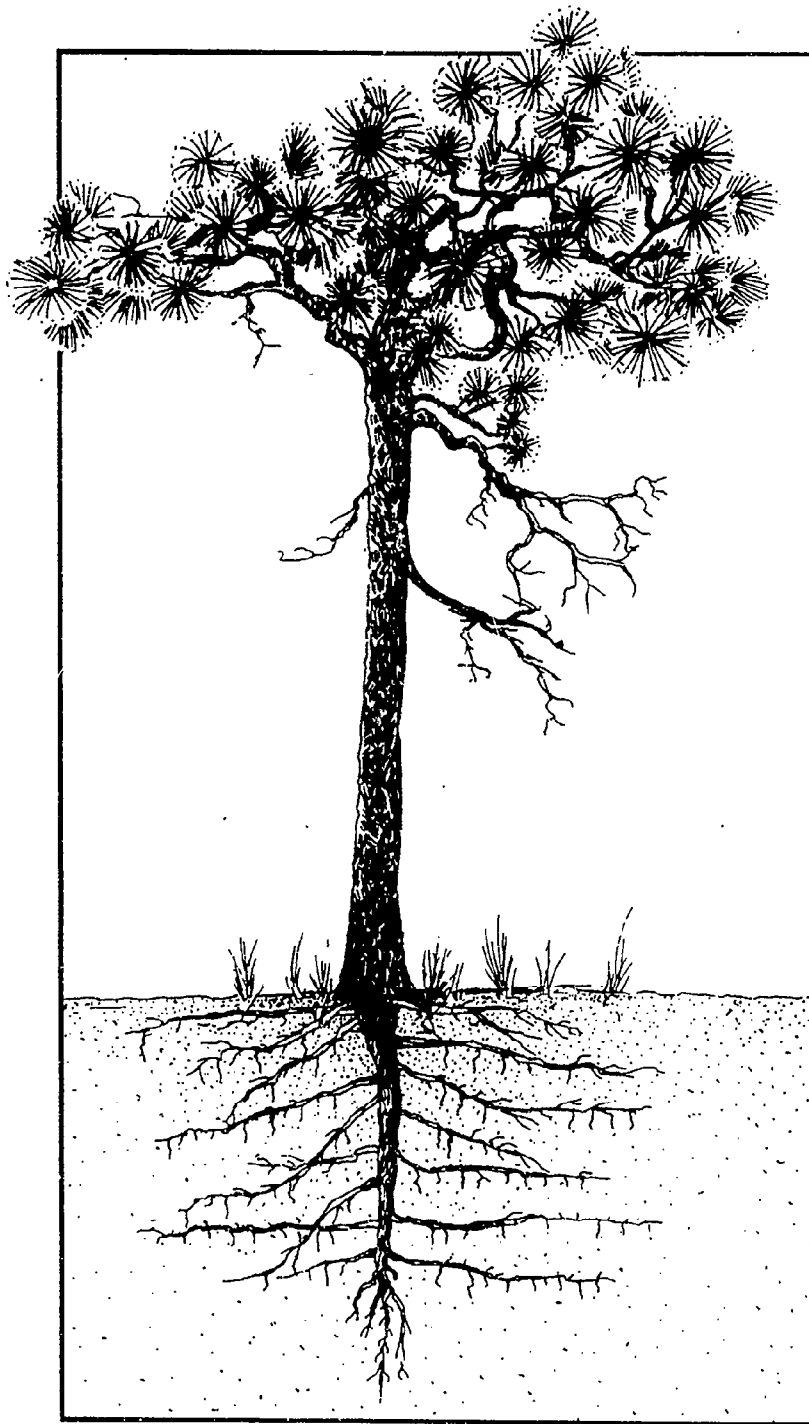


turkey oak

and effective way to maintain the habitat needed by both of these beautiful creatures.

Before European settlers came to this country, the Sandhills burned periodically due to lightning strikes and fires set by Native Americans. The European settlers extinguished all fires to protect their settlements. Soon, the longleaf pine forest filled in with hardwoods and shrubs, and all of the beautiful wildflowers and grasses began to disappear. Scientists discovered that by setting prescribed fires, which mimic natural fires, the native animals, wildflowers and grasses of the Sandhills could be restored.

Weymouth Woods - Sandhills Nature Preserve has a prescribed burning program to manage its longleaf pine forest. The preserve is broken into small sections that are surrounded by **firebreaks** which are mowed and raked to ensure that the fire will remain in the desired areas. These areas are burned approximately every two years when conditions, such as moisture and wind are favorable, and when trained personnel are available. This **resource management** program maintains the unique plant and animal communities of the longleaf pine forest.



Soil Moisture Measurement

The amount of moisture found in the soil is one of the determining factors in the type of plant communities that will grow in an area. Different species of plants have **adapted** to the amount of water needed for survival. The Sandhills region is known for its deep, sandy soils and large amounts of rainfall. However, rain water flows very quickly through these sandy soils and is not held near the surface for long. The Sandhills' plants have adapted by developing extensive root systems. For example, longleaf pine trees develop a long **tap root** that can reach water far underground, even in the dry, hot summer. Other plants, such as wiregrass, develop a root system that is shallow, but very wide and dense. Any water moving down from the surface is soaked up quickly and stored for use in dryer times.

Some Sandhills' plants also have ways to conserve water. For example, young turkey oaks twist their leaves so that the surface of the leaf is not facing towards the sun. This reduces the amount of water lost to **transpiration**.

NOTE:

While you are working on this project, remember that all plants and animals in state parks and recreation areas are protected. Do not disturb the plants by picking or trampling them.

Habitat Needs of the Longleaf Pine Data Sheet

Student's Name: _____

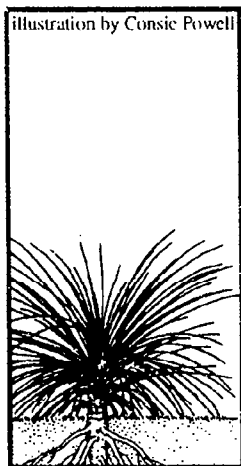
Group: A B C D (circle one)

Burned Plot: An open area, with grasses growing under the canopy of many longleaf pine trees. The trunks of the longleaf pine trees are charred. There is a very thin layer of leaves and needles on the ground.

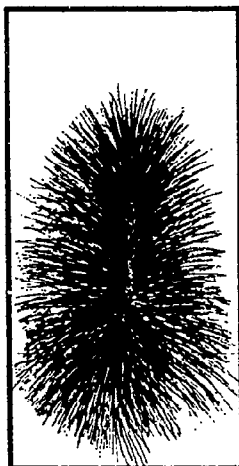
Unburned Plot: A shrubby area, with oak trees growing very thick among only a few longleaf pine trees. The trunks of the trees are not charred. There is a thick layer of leaves and needles on the ground.

Note: The soil moisture meter reads dry soil as close to 0, and wet soils are closer to 10.

Illustrated below are the four growth stages of the longleaf pine. Use these to identify the longleaf pines in your plot.



Seedling Stage
or Grass Stage



Sapling Stage
or Bottlebrush



Mature Stage



Old-Growth Stage

Directions: Complete the data sheet and chart for each plot. Observe your sub-plot and use the soil moisture meter and the information at the top of this page. Remember, count all longleaf pines in your sub-plot no matter what their stage of development.

Plot #: _____
Soil moisture test:

Check one below:
Burned: _____
Unburned: _____

Count # of trees:
Longleaf pines _____
Other trees _____

Plot #: _____
Soil moisture test:

Check one below:
Burned: _____
Unburned: _____

Count # of trees:
Longleaf pines _____
Other trees _____

Plot #: _____
Soil moisture test:

Check one below:
Burned: _____
Unburned: _____

Count # of trees:
Longleaf pines _____
Other trees _____

Plot #: _____
Soil moisture test:

Check one below:
Burned: _____
Unburned: _____

Count # of trees:
Longleaf pines _____
Other trees _____

Study Group Summary Sheet

Directions: Once all members of your study group have finished their own data sheet, complete this summary sheet as a group. Leader #1 will complete the first Study Group Summary Sheet at the first plot, then leader #2 at the second plot, leader #3 at the third plot and leader #4 at the fourth plot.

Group: A B C D (circle one) **Plot #:** _____ (check one)

Leader's name: _____ Burned: _____

Unburned: _____

Soil Moisture Results: Get the members to give you their soil moisture results. Add them up, divide by four to get the average for that plot.

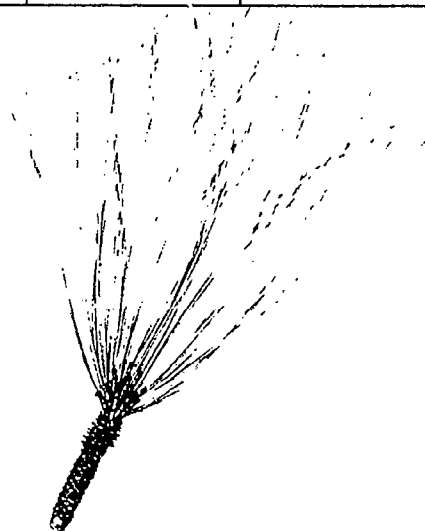
 + + + = ÷ 4 = average soil moisture

1. How would you describe the soil in your plot: a) sandy b) not sandy

(Sandy soils are lighter in color, you can see the individual grains and there is little or no organic matter, such as broken up stems and leaves).

2. Each group member should give you the data from his/her sub-plot on the number of trees that were counted. Complete the chart below and total each line. (Add the numbers across each line.)

Trees	Member #1 # of trees	Member #2 # of trees	Member #3 # of trees	Member #4 # of trees	Totals
Longleaf pines					
Other trees					



Class Summary Sheet

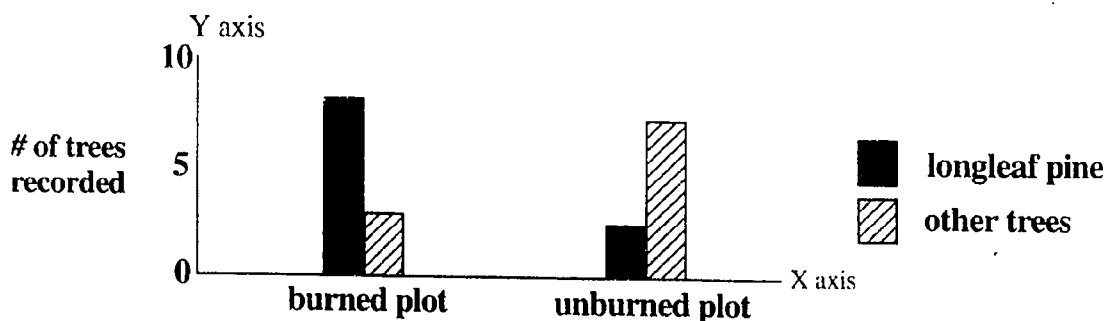
For Educator's Use

1. Once all study groups have been to all four plots and completed the data sheets and the Study Group Summary Sheet(s) for each plot, have the students assemble at the picnic tables behind the Visitor Center.
2. The educator will appoint four students, one from each study group, as spokespersons for their groups. Using their Study Group Summary sheets, they will assist the educator in completing the chart below.
3. Have the spokesperson for each study group write the number of longleaf pines and other trees in the appropriate places on the chart.
4. The educator will average the numbers and create a graph.

Burned Plots (1 & 2)			Unburned Plots (3 & 4)		
Study Group A	longleaf	other trees		longleaf	other trees
Plot 1			Plot 3		
Plot 2			Plot 4		
Study Group B	longleaf	other trees		longleaf	other trees
Plot 1			Plot 3		
Plot 2			Plot 4		
Study Group C	longleaf	other trees		longleaf	other trees
Plot 1			Plot 3		
Plot 2			Plot 4		
Study Group D	longleaf	other trees		longleaf	other trees
Plot 1			Plot 3		
Plot 2			Plot 4		

Total = _____
 $\div 8 = \underline{\hspace{1cm}}$ $\div 8 = \underline{\hspace{1cm}}$ $\div 8 = \underline{\hspace{1cm}}$ $\div 8 = \underline{\hspace{1cm}}$

5. The educator will draw the X and Y axis of the graph on the erasable board. Label the Y axis, "number of trees recorded." Along the X axis, compare the burned and unburned plots. Using a bar graph, show the total numbers of longleaf and other trees for both the plots (see illustration below).



6. Once the graph is complete, use the following questions to start a class discussion.

- a) According to the graph and class observations, which sites had more longleaf pines, the burned or unburned?

Answer: The burned sites.

- b) Why?

Answer: Fire has always played an important role in the survival of the longleaf pine forest ecosystem, whether these fires were natural or started by man. To germinate and grow, longleaf pines need mineral soil and plenty of sunlight. Frequent fires burn away any fallen leaves and expose the sandy soil. Fires also eliminate most hardwoods; this keeps the forest open and allows sunlight to directly reach the ground where many grasses and wildflowers live.

- c) Recall the information from "The Ecology of the Sandhills." In which type of area could the federally endangered red-cockaded woodpecker survive, burned or unburned?

Answer: The burned sites. The red-cockaded woodpecker needs old-growth pines to nest in and open pine forests in which to find food. Without fire, hardwoods would replace the pines that the woodpecker needs.

- d) What is the name of the squirrel that prefers to live in pine forests that have been burned?

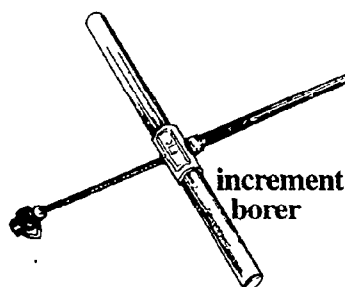
Answer: The fox squirrel. Unlike its relative the gray squirrel, the fox squirrel is able to find food and shelter in the burned longleaf pine forests. It is especially fond of eating longleaf pine cones and feeding on mushrooms that grow in burned pine forests.

- e.) Ask students to compare the burned and unburned plots in terms of the wildlife, or evidences of wildlife, they may have observed.

- f.) Have students debate the pros and cons of using prescribed burns. If a ranger is available, he can answer the students' questions about prescribed burns in the park.

Post-Visit Activity #1

Tree Cookies



Curriculum Objectives:

Grade 5

- **Communication Skills:** listening and visual comprehension
- **Guidance:** competency and skill for interaction with others
- **Science:** plant growth, environment
- **Math:** estimation and counting skills
- **Science:** plant growth, and environment
- **Social Science:** have a sense of time and chronology, participate effectively in groups

Grade 6

- **Communication Skills:** listening and visual comprehension
- **Guidance:** competency and skill for interacting with others
- **Math:** estimation and counting skills
- **Science:** ecology, career in forestry
- **Social Science:** have a sense of time and chronology, participate effectively in groups.

Location: Classroom

Group Size:

30 students, class size

Estimated Time: 30 minutes

Appropriate Season: Any

Credit:

This activity is a modification of an activity in *Project Learning Tree*, published by the American Forest Foundation.

Materials:

Provided by park: mounted cross-section of tree and increment bore section, four quarter sections of the same tree, box of white and red push-pins, 30 magnifying glasses.

Provided by educators:

Per student: "Tree Cookies Data Sheet," Student's Information and pencil

Per group: paper strips, tape and string

Major Concepts:

- Plant growth
- History and environment
- Observation skills

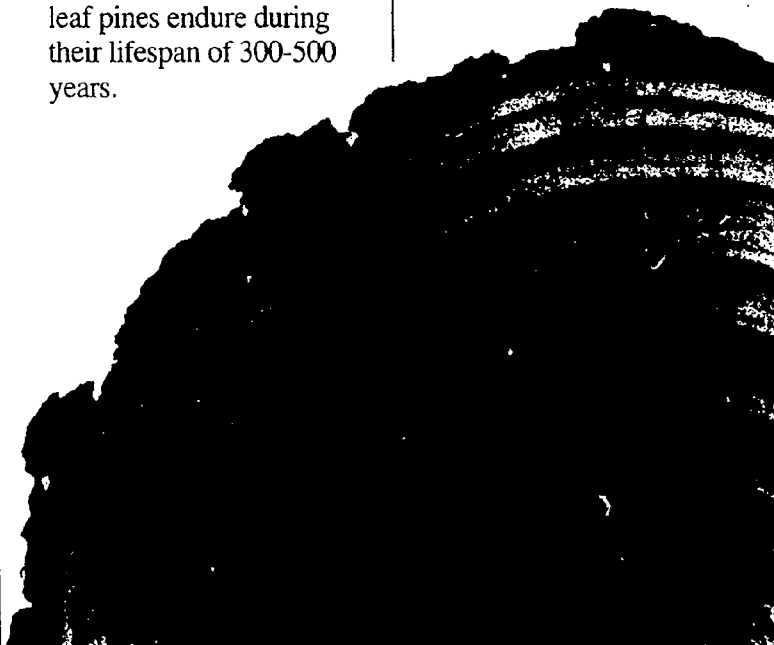
Objectives:

- List four difficulties, natural or human-made, that long-leaf pines endure during their lifespan of 300-500 years.

Educator's Information:

In this activity, the students will observe tree section quarters, called "tree cookies," for their resemblance to pieces of large round cookies. They will learn which historical events occurred during the life of the tree and determine some of the natural and human-made events that may have affected the tree's growth. They will also learn how foresters age a stand of trees.

In your activity kit you should have a mounted tree cross-section, a boring core, four tree quarters, two boxes of push-pins (white and red) and 30 plastic magnifying glasses. Students should read the Student's Information and study the illustrated tree section included in their information.



tion. Have the students observe the mounted whole tree section and core sample. Show the students that the four quarter pieces are from the same tree. The students can be split into study groups of four to five groups (depending on class size) each using a quarter piece. Each study group (if needed) can use the whole section. Since the core sample is from a different age tree, the students will need this sample when answering questions 11-13.

Explain to the students that the core sample is obtained using an instrument known as an **increment borer**. This tool is used by foresters to get

the approximate age of a tree without cutting down the tree. It is a hand drill, with a drill bit on one end and a handle on the other (see illustration on page 5.1.4). The drilling portion of the instrument is a hollow tube with a corkscrew tip that will bore into the side of the tree. Once the handle is attached to the opposite end of the drill, the forester will start to screw the corkscrew bit into the tree. The hollow tube collects a long tubular section of the tree's woody interior. When the corkscrew tip reaches the center of the tree, the forester can pull out an

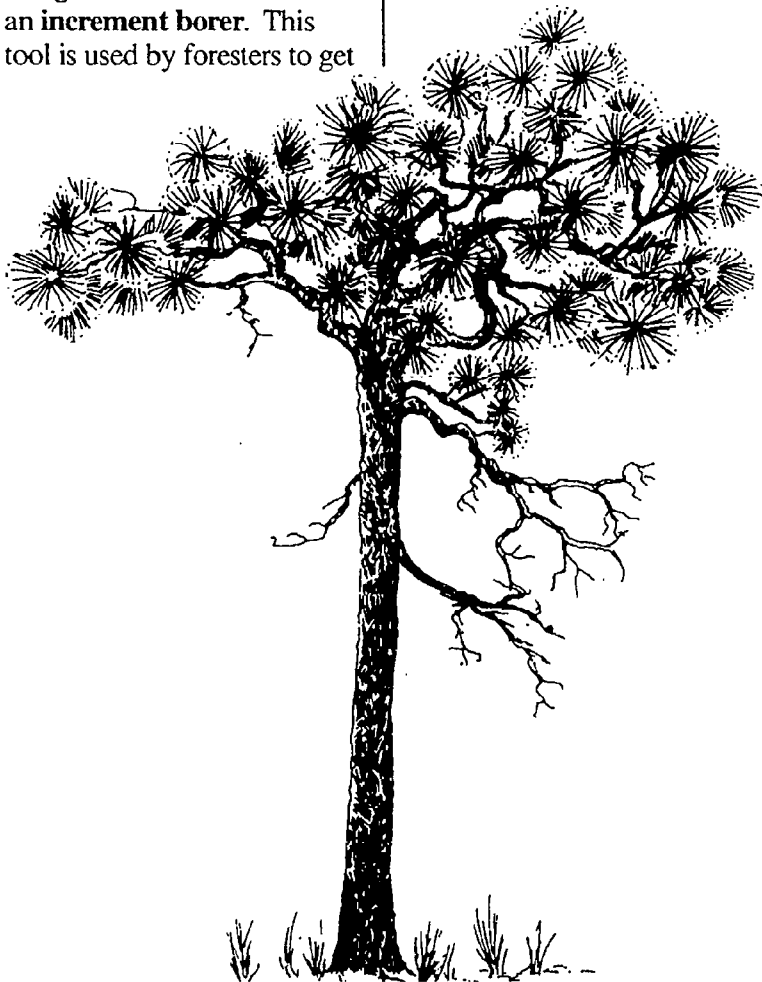
extractor from the back side of the hollow tube. Inside the extractor is the slender core of wood that was collected during the drilling.

Instructions:

1. Have the students read the Student's Information. If needed, have a class discussion to ensure understanding of materials.
2. Place the students in their study groups. Make sure each group has copies of the Tree Cookies Data Sheet, one per group or one to each student (educator's discretion). Each group also needs a quarter cross-cut section, six white push-pins, 10 red push-pins and a magnifying glass for each student. Students may use their Student's Information sheet to help answer the questions.

Hint: The paper strips, tape and string can be used to label the tree cookie for question #9. The educator will check off each group once they have completed this task.

3. Explain the use of an increment borer with the use of the Educator's Information and the illustrations to the class. Since the core sample is from a different age tree, have one group at a time use the core sample to answer the remaining three questions on the data sheet.



Student's Information



Longleaf pines can live from 300 to 500 years. In that span of time they are susceptible to human-made changes, disease or insect infestations and severe fire damage. The trees may grow every year, but because the process is so slow, we do not easily notice it. We see the results of the growth process only in several-year intervals.

Most tree **species** have growth rings (**annual rings**) which can be seen once the tree has been cut. There is an annual ring for every year of new growth. When we count these annual rings from the center to the outside edge, we are counting from the oldest ring to the youngest.

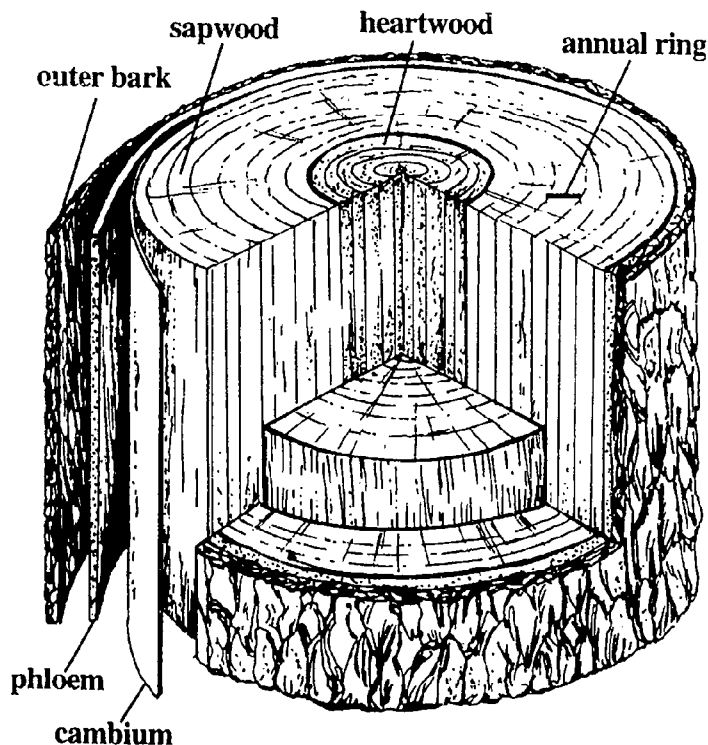
Note: It is important to count only the light or only the dark rings.

The number of annual rings can tell us the age of the tree. The width of each ring can tell us how well the tree is growing. If the annual rings are close together, this could indicate a drought or competition for sunlight with surrounding trees that limited the tree's growth. Another reason for the narrow rings could be a severe fire which **defoliated** the trees and caused a year of slow growth. However, the longleaf pine is very **fire resistant**, giving it an excellent chance to survive the naturally occurring fires typical of the **Sandhills** region. It would be unusual to find a charred line in the annual rings of the longleaf pine, unless the tree had been damaged or the bark

removed before the fire occurred.

Other events, such as disease or insect infestations, may affect the growth of the longleaf pine. These problems can be detected by the tunneling or holes left behind by insects, or a bluish stain indicating disease in the tree. These indicators can occur naturally during the life span of the longleaf pine; however, humans can be an influence in all of these factors.

Human-made marks are indicated by lines cut into the tree, usually in the rings near the outside edge of the tree. These marks were created when people cut the **outer bark** of the tree to collect



resin to make products such as **turpentine**, **pitch** and **tar**.

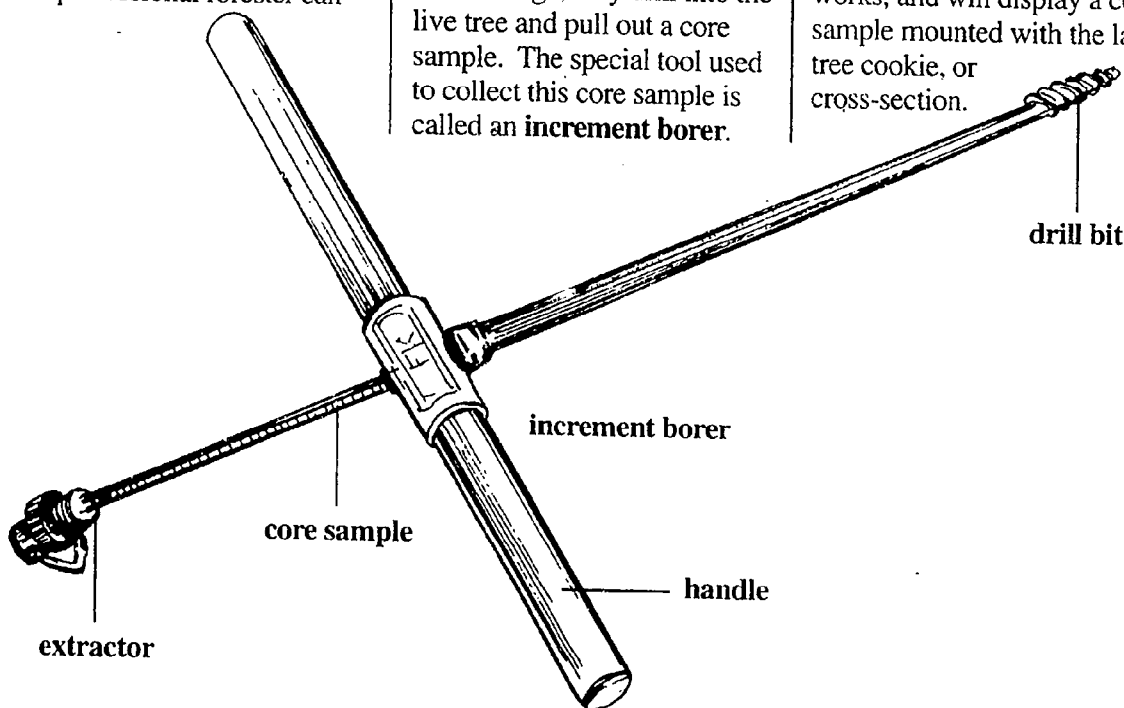
These products were used for **naval stores** or in the **turpentine** industry. Workers in the **turpentine orchards** would scrape or cut the outer bark off the base of the trees, cutting through the **phloem** and into the **cambium** of the tree. The tree would bleed resin and the workers would return later to remove it. The resin was placed in barrels for shipment to the **distillery**. Once the resins were **distilled** the finished products included turpentine, **rosin**, pitch and tar. This type of activity occurred approximately one hundred years ago and the scars left behind can still be seen on some of the trees at Weymouth Woods - Sandhills Nature Preserve.

Today, knowing the history of the Sandhills and its trees, the professional forester can



understand the hardships these trees withstand during their lifetimes. Foresters can estimate the age of the trees by sight. However, to get an accurate age, they drill into the live tree and pull out a core sample. The special tool used to collect this core sample is called an **increment borer**.

This tool does not kill the tree, but leaves a small hole which the tree will heal with its own **sap**. Your educator will tell you how the increment borer works, and will display a core sample mounted with the large tree cookie, or cross-section.



Tree Cookies Data Sheet

Use the tree quarter and a magnifying glass to answer the questions, 1 - 8.

1. Count the annual rings. How old was this tree? _____

2. If this tree were cut in 1994, what year did this tree start growing?

Hint: (Year it was cut) minus (Answer from question #1) = _____

3. How old was the tree when you were born?

Hint: (Answer from question #1) minus (Your age) = _____

Look at the entire tree cookie surface to answer the next few questions.

4. Are the growth rings closer together when the tree was older or younger? _____

5. Describe some of the reasons why the growth rings might be closer to each other in some years and not in others.

6. Do you see any signs of insect or disease problems in the tree cookie?

Such as: Insect Tunnels Yes ____ No ____
 Bluish Stain Yes ____ No ____

7. Do you see a charred line that might indicate a fire occurred during the life span of the tree?

Yes ____ No ____

If your answer is "no" then describe the reasons for no charring on the line below.

8. Is there any sign of human-made scars on the tree cookie? Yes ____ No ____

If your answer is "yes" then describe the human-made marks below.

9. Using the diagram in the Student's Information sheet, find the following parts of the tree. **Find: heartwood, outer bark, sapwood, annual ring.** Mark them on your tree cookie with the white push-pins. Then make tree labels by writing the name of each tree part on a strip of paper. Tape each tree label to a piece of string and attach the string to the white push-pin marking the location of this tree part.

10. Using red push-pins, labels, tape and string as in #9 mark the following historical events that occurred within the tree's lifetime. Hint: Remember the tree was cut in 1994. The most recent ring is the one on the outside.

1. University of North Carolina at Chapel Hill wins NCAA Women's Basketball Championship, 1994
2. University of North Carolina at Chapel Hill wins NCAA Men's Basketball Championship, 1993
3. Canada adopts its Constitution, 1982
4. First walk on the Moon, 1969
5. Dr. Martin Luther King assassinated, 1968
6. Japanese attack Pearl Harbor, 1941
7. Depression begins, 1929
8. Abraham Lincoln assassinated, 1864
9. Civil War begins, 1861
10. Constitutional Congress in Philadelphia, 1787
11. Declaration of Independence, 1776

Note: Your educator will check each of the group's answers for both questions 9 and 10.

Use the tree cores provided by the increment borer to answer the next few questions.

11. How old was this pine tree when the core was taken? _____

12. What is the name of the tool that foresters use to make these cores?

13. What are some of the other things that you can determine from these core samples?

VOCABULARY

- Adapt** - To change or adjust in order to survive.
- Annual ring** - The rings found in the cross-section of trees or shrubs that show one years growth.
- Cambium** - A layer of formative cells between the wood and bark of trees or woody plants.
- Conifer** - Any plant that produces cones and is mostly evergreen.
- Coniferous** (con-i'-fer-us) - A plant that produces seeds in cones.
- Deciduous** (de-sid'-u-us) - Trees and shrubs which lose their leaves during seasonal changes.
- Defoliate** - The removal of leaves or needles from trees or plants.
- Distill** - To refine liquid raw materials by boiling or other method into a usable or saleable product.
- Distillery** - An establishment where raw materials are distilled. Turpentine is distilled from pine sap at a distillery.
- Ecology** - Study of relationships among living and nonliving things.
- Ecosystem** - A community of plants and animals and the nonliving environment, for example, air, water and soil.
- Fertilize** - The joining of a sperm to an egg cell.
- Firebreak** - A barrier of cleared space around an area to be burned which contains the fire to prevent it from spreading. The barrier may occur naturally or may be manually prepared.
- Fire resistant** - The inability to burn easily.
- Habitat** - The place where an organism lives.
- Heartwood** - The innermost wood of a tree.
- Increment borer** - A tool used to measure the age of a tree by drilling in the tree and removing a small core sample of the growth rings.
- Longleaf pine** - A highly specialized coniferous tree, indigenous to the Sandhills region.
- Naval stores** - Products such as turpentine or pitch, originally used in waterproofing wooden ships. The sap from the longleaf pine is ideal for these products. At one time naval stores operations, gathering the sap for these products, severely damaged the longleaf pine ecosystem. In our time this is no longer a threat to the longleaf pine forests.
- Nutrient** - A substance needed for growth and survival.
- Outer bark** - The exterior or visual part of a tree or woody plant.
- Phloem** (flo'-em) - The tissues or tiny tubes that transport food and water to different parts of the plant.
- Pitch** - A black, sticky substance formed by distilling tar, used for waterproofing ships or roofs.
- Plant community** - A group of plants and animals living in a specific region under similar conditions, and interacting with each other through food webs and other relationships.
- Pollen** - Tiny grains that assist in the fertilization of flowering plants.

Pollen cone - A small woody cone that manufactures and stores pollen. They appear on the tree in the spring and are called male cones. See strobili.

Prescribed burn - A fire set to burn vegetation under controlled conditions. This practice safely duplicates natural fires in an effort to improve the habitat for plants and/or wildlife.

Reproduction - To make more of the same; to produce offspring.

Resin - A clear, liquid substance that exudes from an injured plant.

Resource management - Practices, such as prescribed burning, which are designed to improve the habitat of plant/animal communities.

Rosin - A hard, brittle resin, yellow to black in color. The product remaining after turpentine has been boiled down.

Sandhills - Ecosystem of longleaf pine, turkey oak and wiregrass, characterized by sandy flat-topped ridges, in south-central North Carolina.

Sap - The liquid that flows through plants, carrying nutrients.

Seed cone - A large, woody cone that produces seeds. They appear on the trees during the late summer and autumn and are also called the female cone.

Species - Organisms capable of interbreeding.

Strobili (stro-bye'-lye) - Male pine cones. See *pollen cone*.

Tap root - The main root that grows vertically downward from which smaller roots spread out.

Tar - A thick, sticky, brown to black liquid with a bad odor, produced by distillation of tree sap.

Terminal bud - A small swelling at the end of trees or plants from which a new shoot or growth occurs.

Transpiration - The process by which water vapor leaves a living plant and enters the atmosphere.

Turpentine - Any of the sticky, semi-fluid liquids that can be obtained from pine trees.

Turpentine orchards - Trees that were scarred at the base to promote the flow of sap into a collection bucket.

References

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U.S. Department of Agriculture. February, 1989. *A Guide for Prescribed Fire in Southern Forests*. Technical Publication R8-TP11. For information, contact the U.S. Department of Agriculture, Forest Service, Southern Region.

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Wells, B. W. 1967. *The Natural Gardens of North Carolina*. Chapel Hill NC: University of North Carolina Press.

SCHEDULING WORKSHEET

For office use only:

Date request received _____ Request received by _____

1) Name of group (school) _____

2) Contact person _____
name phone (work) (home)

address

3) Day/date/time of requested program _____

4) Program desired and program length _____

5) Meeting place _____

6) Time of arrival at park _____ Time of departure from park _____

7) Number of students _____ Age range (grade) _____
(Note: A maximum of 30 participants is recommended.)

8) Number of chaperones _____
(Note: One adult for every 10 students is recommended.)

9) Areas of special emphasis _____

10) Special considerations of group (e.g. allergies, health concerns, physical limitations) _____

11) Have you or your group participated in park programs before? If yes, please indicate previous programs attended: _____

12) Are parental permission forms required? _____ If yes, please use the Parental Permission form on page 8.2.

I, _____, have read the entire Environmental Education Learning Experience and understand and agree to all the conditions within it.

Return to: Weymouth Woods - Sandhills Nature Preserve, NC
400 N. Fort Bragg Road
Southern Pines, NC 28387

Fax: (910) 692-2167

PARENTAL PERMISSION FORM

Dear Parent:

Your child will soon be involved in an exciting learning adventure - an environmental education experience at **Weymouth Woods - Sandhills Nature Preserve**. Studies have shown that "hands-on" learning improves children's attitudes and performance in a broad range of school subjects.

In order to make your child's visit to "nature's classroom" as safe as possible we ask that you provide the following information and sign at the bottom. Please note that insects, poison ivy and other potential risks are a natural part of any outdoor setting. We advise that children bring appropriate clothing (long pants, rain gear, sturdy shoes) for their planned activities.

Child's name _____

Does your child:

- Have an allergy to bee stings or insect bites? _____
If so, please have them bring their medication and stress that they, or the group leader, be able to administer it.
- Have other allergies? _____
- Have any other health problems we should be aware of? _____

- In case of an emergency, I give permission for my child to be treated by the attending physician. I understand that I would be notified as soon as possible.

Parent's signature

date

Parent's name _____ Home phone _____
(please print) Work phone _____

Family Physician's name _____ phone _____

Alternate Emergency Contact

Name _____ phone _____

NORTH CAROLINA PARKS & RECREATION PROGRAM EVALUATION

Please take a few moments to evaluate the program(s) you received. This will help us improve our service to you in the future.

1. Program title(s) _____ Date _____
Program leader(s) _____

2. What part of the program(s) did you find the most interesting and useful? _____

3. What part(s) did you find the least interesting and useful? _____

4. What can we do to improve the program(s)? _____

5. General comments _____

**LEADERS OF SCHOOL GROUPS AND OTHER ORGANIZED YOUTH GROUPS
PLEASE ANSWER THESE ADDITIONAL QUESTIONS:**

6. Group (school) name _____

7. Did the program(s) meet the stated objectives or curriculum needs? _____

If not, why? _____

Please return the completed form to park staff. Thank you.

Weymouth Woods - Sandhills Nature Preserve, NC
400 N. Fort Bragg Road
Southern Pines, NC 28387
Fax: (910) 692-2167